



# HIGH PERFORMANCE DIGITAL WORKSPACE FOR TRADERS AND SCREEN REAL ESTATE ENTHUSIASTS

Performance, predictability, and centralized computing  
with HPE Moonshot powered by VMware Workspace ONE  
and Horizon



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## EXECUTIVE SUMMARY

This paper outlines a reference architecture for the next-generation trader workstation solution, using the HPE Moonshot system, VMware Horizon®, and VMware Workspace ONE®. By moving the users' compute off large, power hungry, heat generating, and noisy desk-side workstations, and on to HPE ProLiant m750 server blades hosted either in a centralized data center or remote edge location, users free up their existing workplace environment. IT administrators gain the scale-out capability to support thousands of financial users including traders, wealth managers, developers, and more. Users gain the ability to access their data and programs from anywhere and on any device while their data stays more secure, as it is physically located in the data center or a secure edge location, delivered to them through efficient and performant VMware Horizon technology. Each of these deployment types, data center and edge, can be managed by on-premises VMware Horizon infrastructure integrated into VMware Workspace ONE Access™ and Unified Endpoint Management (UEM).

The HPE ProLiant m750 server blade provides a premier end-user compute experience with VMware Horizon, including rich multimedia content such as streaming videos, thanks to the fast 8-core Intel® Xeon® E processor (up to 5 GHz) paired with Intel® UHD Graphics. The HPE ProLiant m750 server blade provides the high-speed, low-latency, and redundant 10GbE networking essential for the trade floor. All of this comes in a platform which is optimized to reduce costly square meter footprint, power, cooling, and complexity of existing desk-side and data-center-hosted financial end-user compute solutions.

HPE m750 can deliver an excellent user experience with the integrated Intel UHD GPU. The proliferation of QHD, UHD, and ultrawide monitors creates a need for additional graphics capability to complement HPE m750 powerful CPU. Certain applications may require additional GPU capabilities, to meet specific resource-intensive user workflows. For deployments that require additional graphical compute power, the HPE m750 server blades may be paired with discrete GPUs, such as the NVIDIA Quadro P1000 (with the HPE EL4000 chassis). Monitor combinations, total pixel count, and how they relate to overall system performance will be covered in this paper.

**Target audience:** This paper is intended for HPE and VMware® partners and customers who seek a framework for the deployment and delivery of high-end digital workspaces powered by the HPE Moonshot system. It is also intended for HPE technical presales and solution architects. A working knowledge of server architecture, networking architecture, and storage design is recommended.

**Document purpose:** The purpose of this document is to describe a recommended architecture or solution, highlighting recognizable benefits to technical audiences. This paper describes testing and validation performed by HPE in 2021. Additional testing and updates to this document should be expected as future advancements and when new server blades are released.



## SOLUTION OVERVIEW

### HPE Moonshot and HPE Edgeline systems with the HPE ProLiant m750 server blades

The HPE Moonshot system is a huge leap forward in infrastructure design that delivers breakthrough efficiency and scale by aligning the right amount of compute, memory, and storage to get the work done. HPE Moonshot 1500 chassis includes all of the common resources from a traditional server—power, cooling, management, fabric, switches, and network uplinks—all shared across 45 hot-pluggable server blades in a dense 4.3U form factor. It replaces a general-purpose processor with more energy-efficient system-on-chips (SoCs) containing integrated accelerators, such as a graphics processor, tailored for specific workloads. The HPE Moonshot 1500 chassis houses dual fully redundant 45-port 1GbE or 10GbE switches, dual uplink modules (16x 10GbE SFP+ or 4x 40GbE QSFP+ connectors each), fans, power supplies, HPE Moonshot 1500 chassis management module 2.0, and up to 45 server blades, with a possibility of up to nine chassis in a single full-height rack.



**FIGURE 1.** HPE Moonshot 1500 (MS1500) chassis

HPE Moonshot server blades can also be hosted in a smaller-form factor chassis, the HPE Edgeline EL4000 Converged Edge System. HPE Edgeline is the industry's first **Converged Edge System**—converging compute, storage, data capture, control, enterprise-class systems, and device management—hardened to thrive in tough environments and handle shock, vibration, and extreme temperatures. The HPE Edgeline systems allow deployment of up to four HPE ProLiant m510, m710x, or m750 server blades, along with associated storage, I/O and expansion options, to locations both inside and outside the traditional data center. The HPE Edgeline EL4000 Converged Edge System hosts the same server blades as the HPE Moonshot 1500 chassis in a reduced footprint that is built for the edge, and also includes space for up to four PCIe cards and one per server blade. The HPE EL4000 is available in different models, including a switched model with two 10 Gb SFP+ ports and a passthrough model with two 40 Gb QSFP+ ports. Each HPE EL4000 houses redundant fans and power supplies and holds four server blades in the 1U system.



**FIGURE 2.** HPE Edgeline EL4000 Converged Edge System



There are a few cases where it may make sense to deploy the solution in an HPE EL4000 chassis instead of an HPE Moonshot 1500 chassis, including any of the following:

- The solution will be deployed outside of a data center, such as at a remote or branch office, with limited power or extended operating temperature ranges.
- The users require additional graphics capabilities beyond the integrated graphics on the HPE m750 server blades.
- The total number of users is less than 20 per deployment site.

The HPE ProLiant m750 server blade is built on the low-power Intel Coffee Lake processing architecture, including an integrated GPU with Intel UHD Graphics P630. Testing was conducted with 32 GB RAM and a single M.2 SSD, which will address nearly all customer use cases, with the ability to add up to 128 GB RAM or multiple SSDs when necessary. HPE m750 is well-suited for end users requiring substantial dedicated processing power and the great end-user experience from single-threaded tasks accelerated by single-core turbo up to 5 GHz. Placed in an HPE EL4000 chassis, which hosts up to four HPE m750 server blades, the GPU capabilities can be further enhanced by adding an NVIDIA® P1000 discrete GPU per blade using the dedicated PCIe x8 slot per blade.

To deliver the experience to the end user remotely, the solution has been tuned for optimal performance with VMware Horizon. The HPE Moonshot system and the HPE ProLiant m750 server blade provide an architecture well suited to support high-end desktops hosted inside or outside the data center, delivering excellent processing and graphical capabilities to the end user over VMware Horizon remote display protocols, including Blast, PCoIP, and RDP. Table 1 describes the specifications of the HPE ProLiant m750 server blade.

**TABLE 1.** HPE ProLiant m750 server blade technical specifications

Component	Description
<b>CPU</b>	Intel Xeon E-2286M, 2.4 GHz (up to 5 GHz Turbo), 8-core
<b>Memory</b>	Up to 128 GB of ECC memory, dual memory channels (4) 32 GB DDR4-2666 MHz LV DIMMs
<b>Network</b>	Dual 10GbE Mellanox ConnectX-4 Pro NICs Supports RDMA over Converged Ethernet (RoCE)
<b>Storage</b>	(4) NVMe M.2 2280 or 22110 (up to 4 TB each) (1) SATA M.2 2242 (up to 240 GB)
<b>Graphics</b>	Integrated Intel UHD Graphics P630
<b>Supported OS for trader workstations</b>	Microsoft Windows 10, Microsoft Windows Server 2016 and 2019
<b>Supported in</b>	HPE Moonshot 1500 chassis (45x) HPE Edgeline EL4000 chassis (4x)

## VMware Horizon and Workspace ONE

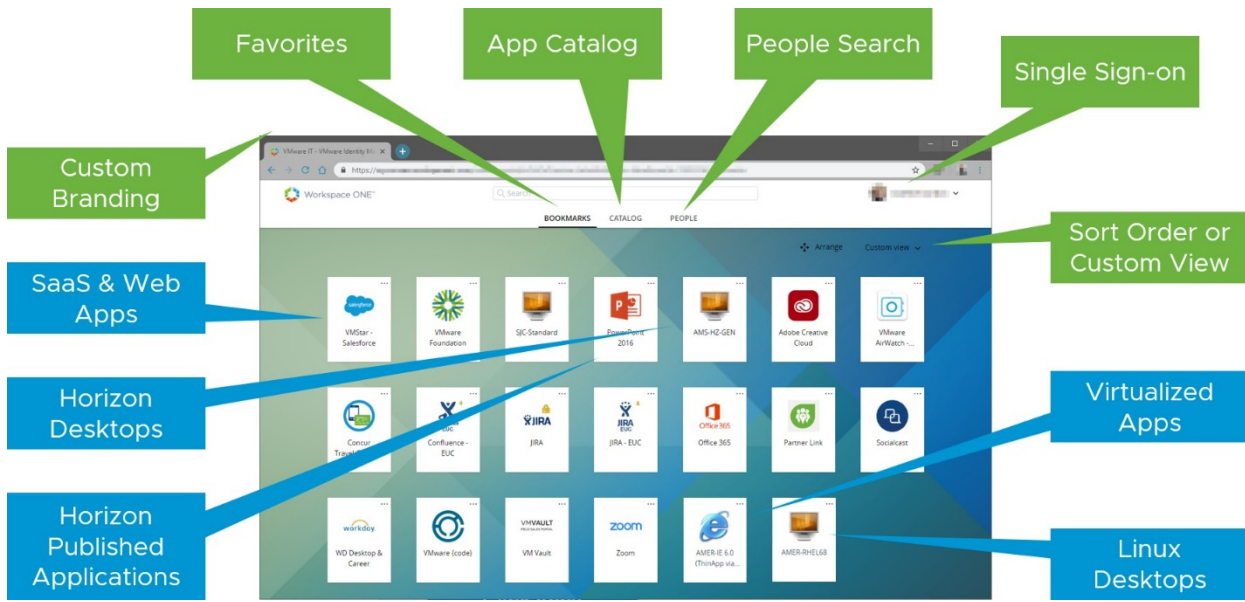
With Horizon, IT departments can run remote desktops and applications in the data center and deliver these desktops and applications to employees as a managed service. End users gain a familiar, personalized environment that they can access from any number of devices anywhere across the enterprise or from home. Administrators gain centralized control, efficiency, and security by having desktop data in the data center.

VMware Horizon is a platform for managing and delivering virtualized or hosted desktops and applications to end users. Horizon allows customers to create and broker connections to Windows virtual desktops, Linux® virtual desktops, Remote Desktop Server (RDS)-hosted applications and desktops and physical machines.

Workspace ONE combines identity and mobility management to provide frictionless and secure access to all the apps and data that employees need to do their work, wherever, whenever, and from whatever device they choose. Device management and identity services are delivered through VMware Workspace ONE Unified Endpoint Management (UEM), and VMware Workspace ONE Access (formerly VMware Identity Manager™).

Additionally, Workspace ONE integrates with VMware Horizon virtual desktops and published applications delivered through Horizon. This integration provides fast single-sign-on (SSO) access to a Windows desktop or set of Windows applications for people who use the service.

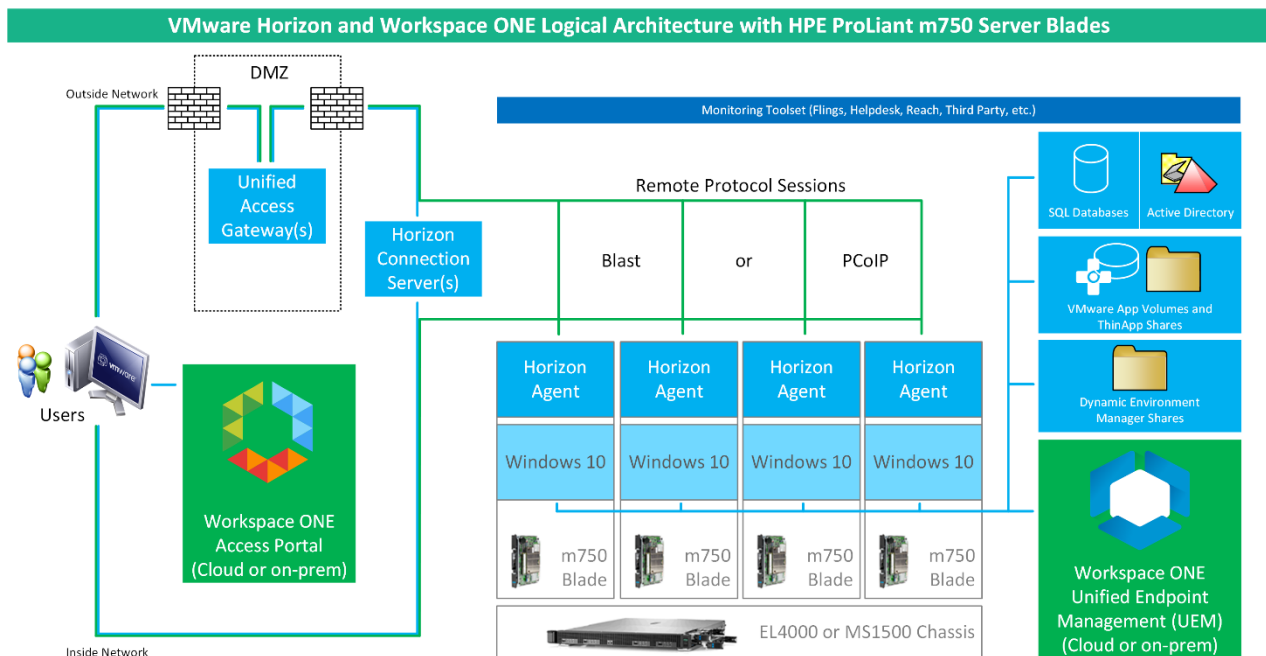




Source: VMware

FIGURE 3. User workspace with VMware Workspace ONE

A successful deployment of Horizon depends on good planning and a robust understanding of the platform. The following diagram shows the logical architecture of the solution, including the following optional components: VMware Workspace ONE Access, Workspace ONE Unified Endpoint Management, Dynamic Environment Manager, VMware App Volumes™, and VMware ThinApp®. Each optional component has been tested with the HPE ProLiant m750 and can be integrated to build the VMware Horizon and Workspace ONE solution shown in Figure 4.



Source: VMware

FIGURE 4. VMware Horizon and Workspace ONE logical architecture diagram



## Screen resolutions and definitions

The amount of data available to traders has significantly increased over the last couple of years. Therefore, it comes as no surprise that the demand of screen real estate is constantly increasing, with traders pushing for more and higher resolution screens at their desks. It is important to understand the different resolutions available and how they impact both the client and server side of a trading solution. Table 2 highlights the most common screen resolutions used on trading floors around the world.

**TABLE 2.** Screen resolutions and definitions

Definition	Resolution	Megapixels	Comment
Full HD (1080p)	1920x1080	2.1 megapixels	Minimal expectation for traders
WQHD (1440p)	2560x1440	3.6 megapixels	Sometimes referred to as 2K or QHD
UHD (2160p)	3840x2160	8.3 megapixels	Commonly called 4K, which is a wider cinema specification at 4096x2160

## Client hardware

The client-side hardware consists of a client machine to connect to the VMware Horizon session hosted on the HPE m750 server blade, monitors to display the session, and any additional peripherals needed by the user. With the VMware Horizon solution, users can access their desktops from any endpoint device. That stated, endpoint device selection, testing, and review are important to deliver a consistent and quality user experience to the traders or other users in an organization. Special considerations must be taken for support of a typical financial use case that includes two or more UHD monitors at the user's desk. Two to four ultra-high-resolution monitors afford the end user plenty of screen real estate to increase their productivity and efficiency, even with multiple simultaneous workflows. However, driving up to four UHD monitors requires an endpoint with a CPU and GPU powerful enough to handle delivering that many monitors of rich content, including multimedia and applications simultaneously. Many configurations are possible, and tested configurations will be discussed in the [Capacity and sizing](#) section.

Depending on the physical screen count on the client side, HPE has tested and can recommend the HP t640 and HP t740 Thin Clients. With HP t640 based on the AMD Ryzen R1505G, HP Inc. offers a small yet powerful thin client capable of driving up to three UHD screens at 60 Hz. For more than three physical screens, the HP t740 Thin Client is recommended as a small and quiet client device with expandable graphics ports. Configured with an AMD Ryzen processor with both Vega 8 and optional discrete AMD Radeon E graphics adapter, the t740 thin client supports up to six UHD monitors at 60 Hz while providing a responsive end-user experience with VMware Horizon. Note that at this time, the HPE Moonshot solutions only support up to four UHD screens; however, the six physical display ports of HP t740 can be used to drive up to six lower resolution monitors such as QHD or Full HD.

Additional peripherals may include common USB devices such as flash drives, webcams, and microphones, or specialized hardware to interface with specific software suites, such as a Bloomberg keyboard and biometric authentication devices to use with Bloomberg Terminal software. These and many other peripherals have been tested and are supported with current versions of VMware Horizon. Identification and testing of any required peripherals are always recommended prior to a production deployment of a new VMware Horizon environment and during the pre-upgrade testing of new releases.

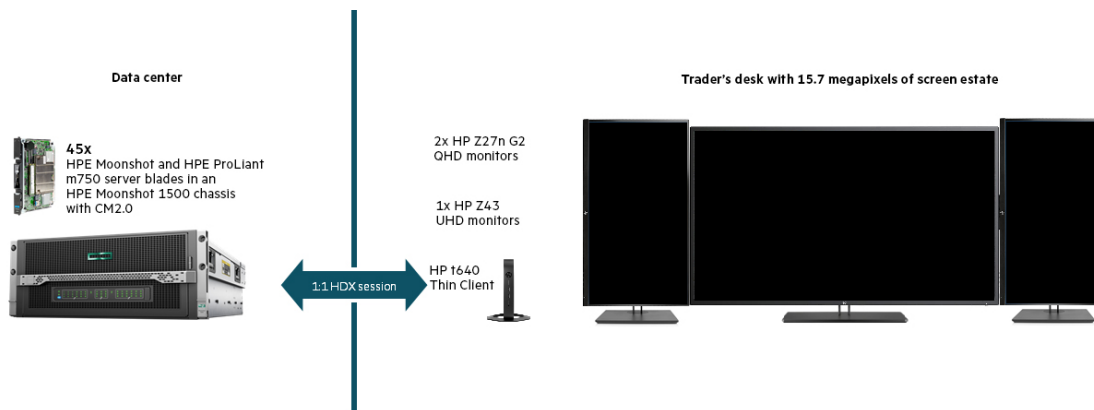
## Putting it all together

The HPE ProLiant m750 server blade, with HP t740 Thin Client and VMware Horizon, is an ideal combination of form factor, density, size, and compute and graphics capability for high-performance desktop users. It provides excellent processing power, responsive graphics, and an exceptional end-user experience that is scalable and predictable as adoption increases. In a traditional trading environment, high-powered tower PCs generate extra heat, are noisy and lack centralized computing controls necessary to provide mobility and security for the modern digital workspace.

When compared to Horizon virtual desktop solutions on VMware vSphere®, the HPE Moonshot and HPE ProLiant m750 solution provides a high-performance, predictable user experience, which does not degrade with increased user density on a traditional hypervisor-based deployment. Traders and screen real estate enthusiasts demand the best, most reliable, and predictable experience when consuming digital services, just as they do today with physical workstation-based solutions. The HPE ProLiant m750 hardware can deliver the performance that these users demand while not sacrificing user experience as the solution scales to address dozens, hundreds, or thousands of simultaneous concurrent users.

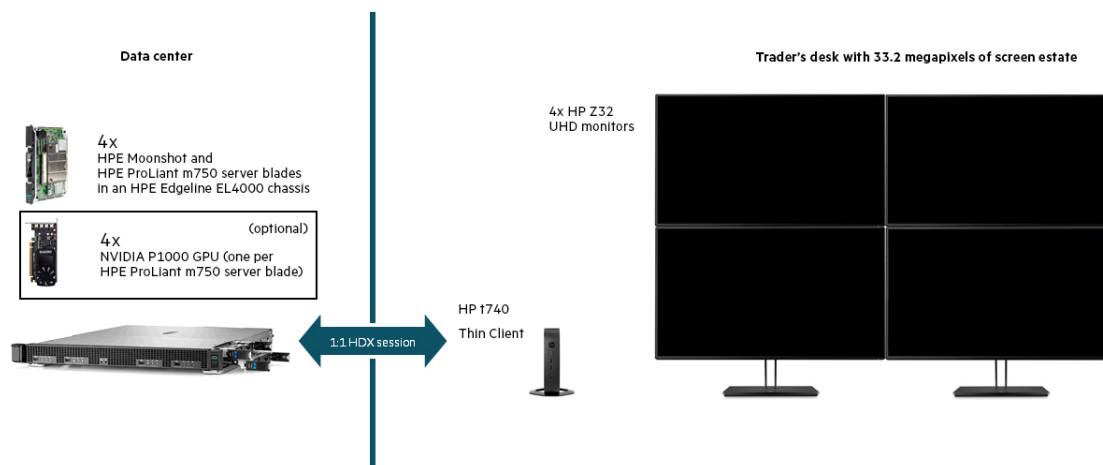
Figure 5 shows a diagram of the solution layout for up to 15.7 megapixels, including the HPE Moonshot compute hosted in an HPE Moonshot 1500 chassis and VMware Horizon infrastructure in the data center and the client hardware at the users' desks with different endpoint options.





**FIGURE 5.** HPE Moonshot solution setup supporting up to 15.7 megapixels with sample screen configuration

Figure 6 shows a diagram of the solution layout for up to 33.2 megapixels, including the HPE Moonshot compute hosted in an HPE Edgeline EL4000 chassis and VMware Horizon infrastructure in the data center and the client hardware at the users' desks with different endpoint options. The NVIDIA P1000 discrete GPUs are optional and recommended for customers who require the best user experience using more resource-intensive applications.



**FIGURE 6.** HPE Moonshot and HPE Edgeline solution setup supporting up to 33.2 megapixels with sample screen configuration

## CAPACITY AND SIZING

### Test setup

For the testing in this document, HPE ProLiant m750 server blades were housed inside an HPE EL4000 chassis. Tests were performed with both the integrated Intel UHD Graphics P630 and the discrete NVIDIA Quadro P1000. Table 3 describes the specifications of the option NVIDIA Quadro P1000 discrete GPU, available in the HPE Edgeline EL4000 chassis.

**TABLE 3.** NVIDIA Quadro P1000 GPU specifications

Component	Description
GPU memory	4 GB GDDR5
Memory interface	128-bit
Memory bandwidth	Up to 82 GB/s
NVIDIA CUDA Cores	640
System interface	PCI Express 3.0 x16
Maximum power consumption	47W
Thermal solution	Active
Max. simultaneous displays	4
Max. display resolution	4x 4096x2160 @ 60 Hz (35.4 megapixels) 4x 5120x2880 @ 60 Hz (59 megapixels)
Supported in	HPE Edgeline EL4000 (4x)





Table 4 describes the four specific monitor configurations that were examined and tested.

**TABLE 4.** Tested display configurations

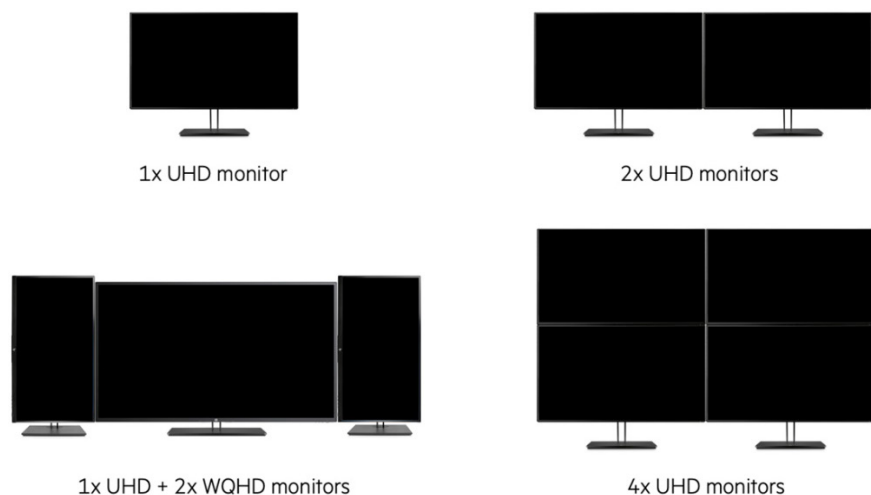
**Monitor configuration**

2x UHD (3840x2160) monitors in landscape mode.

4x UHD (3840x2160) monitors in portrait mode.

1x UHD (3840x2160) monitor in landscape + 2x WQHD (2560x1440) monitors in portrait mode.

4x UHD (3840x2160) monitors in quadrant or landscape mode



**FIGURE 7.** Tested display configurations

**NOTE**

If utilizing the integrated Intel UHD Graphics, the HPE m750 server blade can be deployed in either HPE Moonshot 1500 or HPE Edgeline EL4000 chassis. To use an external graphics card, such as the NVIDIA Quadro P1000, HPE m750 must be deployed in the HPE Edgeline EL4000 chassis.

For up to four UHD (3840x2160) monitors, testing was performed with and without an NVIDIA Quadro P1000 (discrete) graphics card. Based on extensive testing, the Intel UHD Graphics P630 hardware capabilities have proven technically capable to support this configuration without a discrete graphics card. User experience and system resource exhaustion without a discrete graphics card is largely determined by the trading user applications and intensity of the workloads being utilized. There are no technical limitations that would prevent a customer from deploying four UHD monitor configurations without a discrete graphics card, and in certain scenarios this may make more sense, particularly to take advantage of the HPE MS1500 chassis with greater rack density. However, for the more demanding trading user workloads, it's advised to deploy the HPE m750 solution with the HPE Edgeline EL4000 chassis combined with a discrete graphics card per user. Examples where a discrete graphics card would be recommended involve general-purpose computing on GPU (GPGPU) powered applications, which leverage OpenCL, NVIDIA CUDA or Quadro, Microsoft DirectCompute, or other advanced visualization or GPU accelerated 3D applications such as Adobe, Autodesk, Dassault, PTC, Siemens, and other industry-specific independent software vendors (ISVs).

Windows 10 LTSC 1909 and 20H2 were tested and used with the latest HPE Moonshot Component Pack (2020.08.0).

Testing was conducted within a low-latency local area network (sub 1 ms RTT).

This solution assumes that Active Directory, DNS, Horizon Connection Servers, and other supporting infrastructure already exist. Testing was performed using Horizon 7.10-7.13 and Horizon 8 2006–2012 for both Connection Servers and Agents. For the best possible experience, use the latest release of the Horizon Client for the given endpoint platform (Windows or Linux). Testing was performed using Horizon Client 2006 and 2012 for both Windows and Linux.



Very minor differences in user experience were observed, dependent on the Horizon Agent version being utilized. Therefore, it is advised to use the Horizon Agent version that aligns with the Connection Server infrastructure deployed, no older than Horizon 7.10 and aligning to Extended Service Branch (ESB) releases, where appropriate for a given customer environment. Unless prohibited by other environmental factors, it's recommended to use the latest available version of the Horizon Agent for the latest features and performance enhancements.

Both PCoIP and Horizon Blast protocols were utilized throughout the testing, with minor differences in user experience being observed dependent upon the applications and workload being tested. A side-by-side comparison of PCoIP versus Blast with quantitative data analysis was not performed as part of the testing effort. In general terms, either protocol is supported and delivers a high-quality user experience to be expected from the solution. While the Microsoft RDP protocol in Windows 10 1909 or 20H2 may be utilized through Horizon, it is not advised to do so. For optimal user experience and to take advantage of hardware capabilities of the HPE ProLiant m750 and HP t740 Thin Client, use the H.264-optimized Blast protocol with this solution. The PCoIP protocol was also tested and may be utilized if specific environmental conditions require PCoIP, such as remote access network connectivity, existing WAN optimization solutions, or endpoints already deployed. Based on the testing performed on the HPE ProLiant m750, the Blast protocol delivered the best and most reliable experiences when configured in alignment with the recommendations provided in this document.

### Workload description

The workload used for desktop performance and end-user experience characterization is based on simulating real-world usage of high-end desktops in the financial industry. It includes the following applications, all running simultaneously:

- Google™ Chrome and Microsoft Edge: Playing multiple simultaneous 4K video streams (audio muted)
- Microsoft Office and specifically Excel benchmarks: Running macros to continuously randomize and calculate tens of thousands of values
- Thomson Reuters Eikon: Set to a dashboard showing constantly changing live market price updates
- Microsoft Teams: Sharing a single screen in a live call
- Adobe Reader: Scrolling a PDF to evaluate fluidity and responsiveness
- Media Player (Spotify): Playing background music to ensure no stutter, jitter, or audio drops experienced

In addition to the workload applications, the HPE m750 server blade is also running performance collection tools, including VMware Horizon Performance Tracker, to accurately capture frames per second and latency data.

Each high-end desktop user maps to a separate, individual server blade with independent compute, GPU, memory, and disk, and therefore solution sizing is predetermined at one user per server blade. The purpose of this workload testing is to determine end-user experience. End-user experience is measured objectively here through frames per second delivered and round-trip latency metrics, and system performance metrics are captured if needed to characterize any degradation in end-user experience. For example, if the frame rate drops below 10 frames per second, there must be some limiting factor in the environment: CPU on the client or server, GPU on either device, network, or some other factor.

### System performance data

The following views from Task Manager and VMware Horizon Performance Tracker show an HPE ProLiant m750 system connected via an HP t740 Thin Client with four 4K monitors under a heavy workload. The Task Manager view shows heavy CPU, GPU, and network usage with minor usage of RAM and disk. The Performance Manager view shows bandwidth usage and frames per second (FPS) varying between 15 to 30 throughout the test. From a user and endpoint standpoint, the Blast protocol session did not experience any noticeable degradation, and there was no impact to interactivity, responsiveness, or usability.



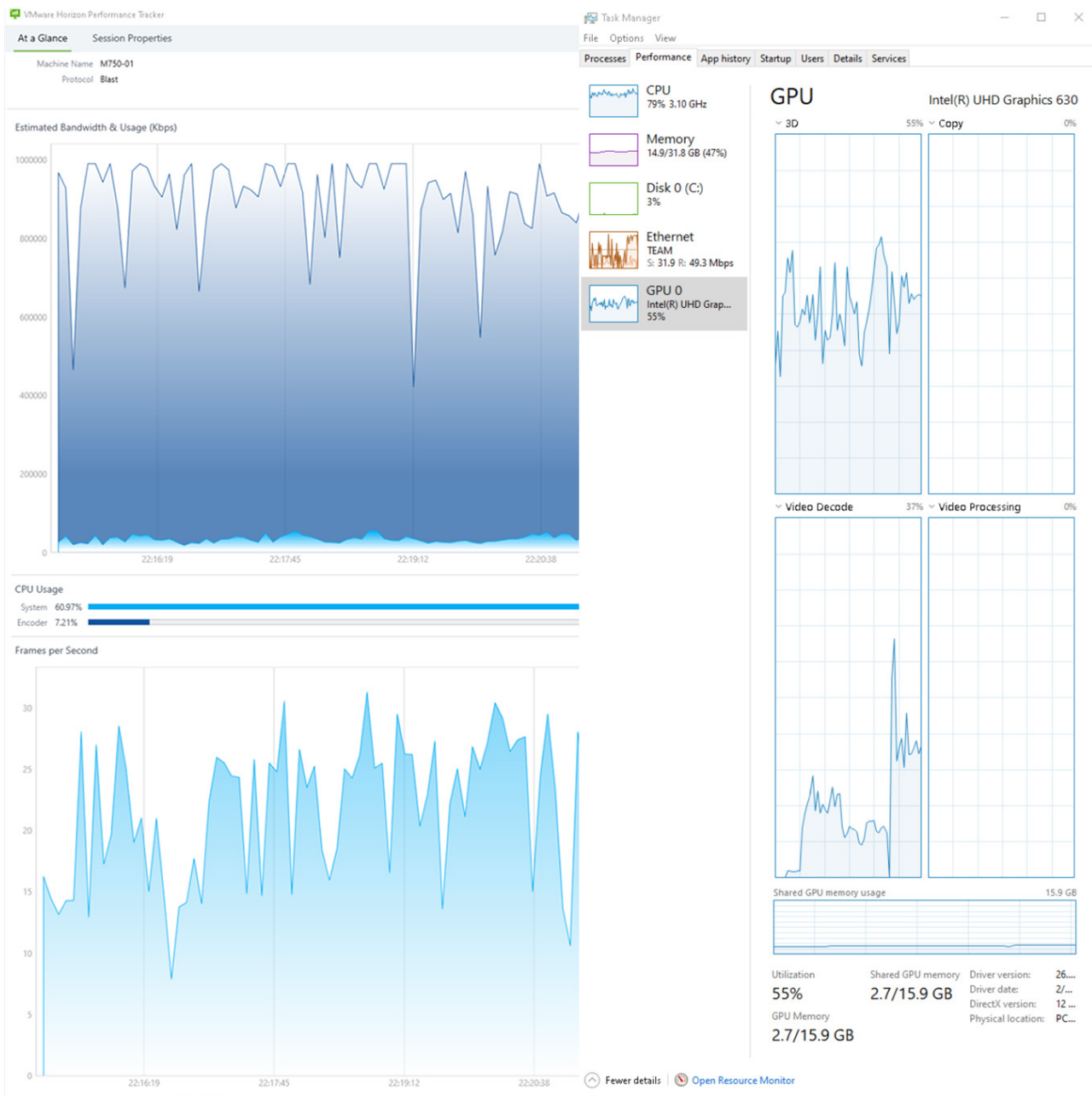


FIGURE 8. System performance data

Table 5 describes the performance benchmarking tools and results.

TABLE 5. Performance benchmarking tools and results

Performance benchmarking tool	Results
Cinebench—8c/16T @ 2.4 GHz, Intel Xeon E-2286M CPU	2819
CrystalDiskMark read MB/s (SEQ1M Q8T1)	1285 MB/s
CrystalDiskMark write MB/s (SEQ1M Q8T1)	575 MB/s
lometer (4K transfer, 80% random, 80% write)—Total I/O per second	36,037 IOPS
lometer (4K transfer, 80% random, 80% write)—Total MB per second	140 MB/s



## Results summary

The results show that the HPE ProLiant m750 server blade is not a limiting factor for the tested workload, with and without a discrete graphics card. Even under load between 50% to 75% utilization on CPU and GPU resources, a high-quality user experience, fluidity of screen updates, and responsiveness was maintained throughout all tests. With the workloads being utilized, application launches and responsiveness were excellent as the SSD disk performance was never impacted, and memory (RAM) utilization did not go above 40% of the 32 GB available. Therefore, the resources under high pressure during benchmarking tests were CPU and GPU, with lower utilization being observed with the discrete graphics card. Differences in performance will be observed with different endpoint devices, Horizon protocol configurations, and different monitor variations. HP t740 Thin Client is powerful enough to maintain an excellent end-user experience, even with four UHD monitors attached. In all tests and with all monitor configurations, the system was able to maintain 15 to 30 frames per second (FPS) with less than 1 ms round trip time (RTT) responsiveness. Instances where the frame rate dropped below 15 FPS were generally attributed to lack of interaction with the system, not related to any performance constraint. Throughout the testing efforts, Horizon Performance Tracker and Performance Monitor (perfmon) counters did not report frame rates above 30 FPS.

## Recommendations

### IMPORTANT

During testing, it was observed that due to low network latency conditions (< 1 ms), the Blast protocol transport would switch from UDP + TCP (default) to TCP only. This transport switchover can be observed using the VMware Horizon Performance Tracker. Immediately following the switch to TCP, the user experience would degrade with a noticeable difference in responsiveness (fluidity of interaction), audio and video stuttering, or drops. To ensure Blast sessions utilize a combination of UDP and TCP transport, it's highly recommended to disable Blast Extreme Network Intelligent Transport using the registry key provided in the following.

While both PCoIP and Blast protocols were tested, the optimal user experience can be achieved using the following recommended configuration.

### Horizon Client configuration

**TABLE 6.** Horizon Client configuration

Option	Selection
Allow H.264 decoding	Checked
Allow high color accuracy (reduced battery life and performance)	Unchecked
Allow High Efficiency Video Decoding (HEVC) By default, not available on HP t740 running ThinPro (Linux)	Unchecked
Display protocol	Blast
Recommended HP t740 OS	ThinPro (Linux)

### Horizon Agent configuration

**TABLE 7.** Horizon Agent configuration

Option	Selection
Max. frame rate Configured through VMware Blast ADMX	60 (Default is 30.)
Configure clipboard redirection Configured through VMware Blast ADMX	Enabled in both directions
Blast Extreme Network Intelligent Transport Create the following registry key: HKLM\SOFTWARE\VMware, Inc.\VMware Blast\Config\NetworkIntelligenceEnabled=0 (REG_SZ)	Disabled



## FREQUENTLY ASKED QUESTIONS

### **Q: What are the Microsoft licensing requirements?**

**A:** Any volume license (non-OEM) version of Windows 10 is required. Software assurance or other maintenance options are recommended for New Version Rights, Roaming Use Rights, and other Microsoft benefits. For ease of license activation and management during deployment, a KMS server is recommended for the OS and Office products. Customers may prefer to license their OS and Office products through the Microsoft 365 subscription service.

### **Q: What are the VMware licensing requirements?**

**A:** With VMware's shift to subscription-based licenses for VMware Workspace ONE and Horizon, options have been greatly simplified. To use the full Workspace ONE Unified Endpoint Management (UEM) capabilities for OS and device management, customers should purchase the Workspace ONE Enterprise for VDI subscription. For all other customers, the Horizon universal license subscription is required. For more information, see [VMware Horizon Service Universal License frequently asked questions](#).

### **Q: What are the network requirements?**

**A:** The HPE Moonshot 1500 chassis can be connected to the network using 10G, ideally 40G QSFP+ if available. The HPE Edgeline EL4000 chassis can be connected to the network using 1G RJ45/SFP transceivers for remote offices or branch offices where 10G is either not available or cost prohibitive. For a complete list of networking options, see [Appendix C: Resources](#) for each hardware platform.

### **Q: How should the OS, VMware Horizon Agent, and other software be installed?**

**A:** For an initial evaluation or small-scale deployment, installation of the OS, hardware drivers, VMware Horizon Agent, Workspace ONE Intelligent Hub, and any other software can be completed manually through the HPE Integrated Lights Out (iLO) console, following VMware's guidance on [Creating Optimized Windows Images for VMware Horizon Virtual Desktops](#). For standardized deployments in larger environments, fully automating the installation and configuration process is critical to ensure consistency and uniformity for ideal user experiences and supportability. Automating the deployments will ensure that systems can be reimaged quickly and efficiently when assignments or access change. Once deployed, the systems can be managed using Workspace ONE UEM, System Center Configuration Manager (SCCM), or other agent-based device management platforms.

### **Q: When should a discrete GPU such as the NVIDIA P1000 be used with this solution?**

**A:** For most traders and other screen real estate enthusiasts, the onboard Intel UHD Graphics will be capable to drive a quality user experience, including up to four UHD monitors with VMware Horizon Blast as outlined in this document. However, there are always industry-specific applications and independent software vendors (ISVs) that develop solutions to leverage advanced GPU-accelerated compute (GPGPU) or advanced visualization 3D applications, which demand a higher-powered discrete graphics adapter. When considering a new hardware solution, it's always recommended to develop an inventory of all applications that will be deployed and review vendor-provided documentation for minimum hardware requirements. If software vendors require advanced GPU features for optimal performance, the discrete GPU option combined with the HPE EL4000 chassis is recommended. Examples of these advanced features include OpenCL, NVIDIA CUDA or Quadro, Microsoft DirectCompute. Examples of industry-specific software vendors include Adobe, Autodesk, Dassault, PTC, and Siemens to name a few. When a discrete NVIDIA GPU, such as the P1000, is utilized with this solution, customers will also benefit from the Horizon Blast protocol encoding solution provided by the NVIDIA Encoder (NVENC). NVENC offloads the compute-intensive remote protocol encoding operation from the CPU, thereby delivering an even more responsive experience with lower CPU overhead.

## SUMMARY

Many enterprise users require high-end desktops with fast processors and powerful graphics to cover a broad spectrum of use cases. Financial traders in particular require top-notch performance, all the time, in addition to increased security due to the sensitive nature of the data they work with. In addition, their IT departments want a simplified way to manage all these high-end desktops, without having to fight the constant battle of never-ending hardware refreshes.

The HPE Moonshot system and the HPE ProLiant m750 server blades can address these requirements, providing a high-end compute node with graphics, hosted securely in the data center or a locked closet in a remote branch office. The end user enjoys an excellent user experience and a desktop that they can access from anywhere their IT policies allow them to, thanks to VMware Horizon and PCoIP or Blast remoting protocols. With Workspace ONE for Windows 10 modern management, this capability is easier than ever to support and manage throughout the entire OS and application lifecycle. Furthermore, the HPE Moonshot system increases density and efficiency when compared to more traditional solutions—lowering operating costs such as data center space, cabling, and cooling.



## APPENDIX A: CONFIGURATION GUIDANCE

This section will cover best practices and tuning parameters that are specific to this high-end desktop implementation and were used in the benchmark described in this document.

For information on obtaining the appropriate Windows 10 drivers for the HPE ProLiant m750 server blade, see the “Drivers” section in the [HPE Moonshot Component Pack 2020.08.0 Release Notes](#). Specific network implementations and considerations are addressed in the [HPE Moonshot Networking Cookbook](#). For more information regarding OS deployment, including special cases and alternative methods, see [Operating System Deployment on HPE ProLiant Moonshot Cartridges and Server Blades](#). For all other information on the HPE Moonshot servers and platform, visit the [Hewlett Packard Enterprise Information Library](#).

For information on optimizing the Blast Extreme protocol for VMware Horizon, see the [VMware Blast Extreme Optimization Guide](#).

### HPE ProLiant m750 server blade BIOS/RBSU parameters

For best performance, the recommended deployment method is Windows 10 installed bare metal on each server blade. While it is possible to install a hypervisor with a Windows 10 VM on an HPE m750 server blade, bare-metal installation eliminates a layer of abstraction from the hardware and the accompanying performance penalty.

First, the BIOS Power Profile should be set to **General Power Efficient Compute**, which is the default setting. This can be accessed by pressing F9 during system boot and choosing System Configuration > BIOS/Platform Configuration (RBSU) > Workload Profile and set it to **General Power Efficient Compute**.



FIGURE 9. RBSU power profiles in the BIOS of HPE ProLiant m750

In order to ensure the correct use of the GPU options (either onboard or discrete), make sure to disable the HPE iLO console in the BIOS as follows:

1. For deployments using the integrated on-board GPU (Intel), please select the following options in the BIOS (System Configuration > BIOS/Platform Configuration (RBSU) > Advanced Options):

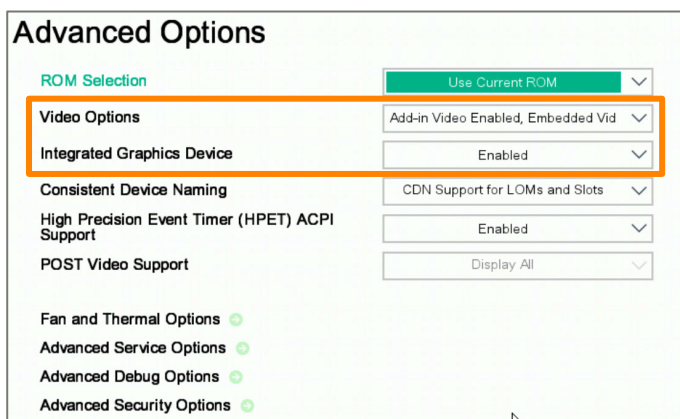
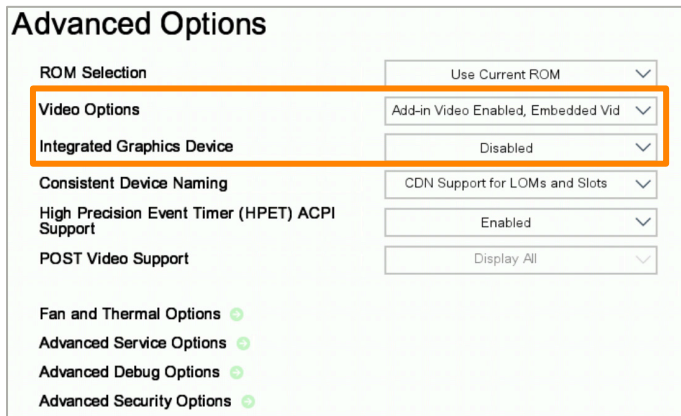


FIGURE 10. RBSU Advanced Options in the BIOS of HPE ProLiant m750 for using the onboard GPU

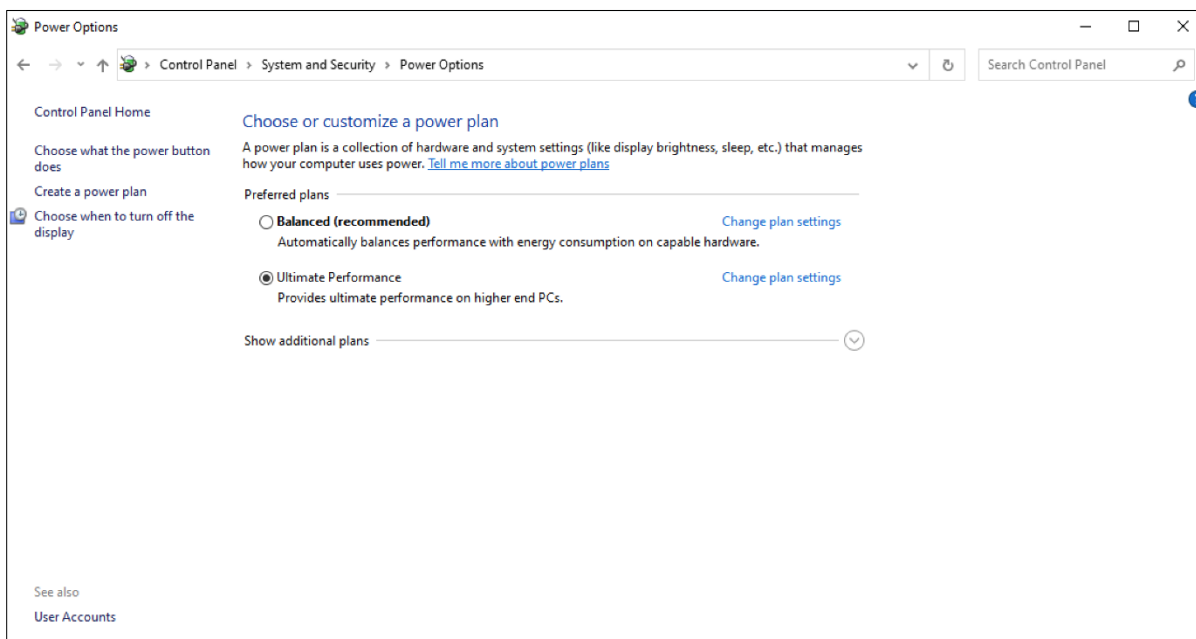


2. For deployments in an HPE Edgeline EL4000 using discrete GPUs (NVIDIA), please select the following options in the BIOS (System Configuration > BIOS/Platform Configuration (RBSU) > Advanced Options):



**FIGURE 11.** RBSU Advanced Options in the BIOS of HPE ProLiant m750 for using the discrete GPU

The power plan within Windows should be set to Ultimate Performance to avoid unnecessary CPU throttling and can be changed from the Control Panel under Hardware > Power Options.



**FIGURE 12.** Windows 10 power plan option for HPE ProLiant m750

While it is good to ensure that Windows is up to date through Windows Update, be sure that the Windows-suggested Intel graphics and Mellanox network drivers are not installed through Windows Update. Instead, get the latest graphics and network drivers from the HPE ProLiant m750 server blade firmware and software package on [support.hpe.com](http://support.hpe.com).

To prevent Windows Update from installing new driver versions in Windows 10, open the Local Group Policy Editor (or Group Policy Management Console), and under Computer Configuration > Administrative Templates > Windows Components > Windows Update, double-click the **Do not include drivers with Windows Updates** option in the right pane. Set the option to **Enabled** and click **OK**. You may need to restart your PC before this setting takes effect.



## APPENDIX B: BILL OF MATERIALS

The bill of materials (BOMs) presented in Tables 8 through 11 are sized for two different deployment types:

- Table 8 shows 45 high-end desktop users or one fully populated HPE Moonshot 1500 chassis.
- Table 9 shows 4 high-end desktop users or one fully populated HPE Edgeline EL4000 chassis.

Both of these options can easily be scaled up or down by either reducing the number of HPE m750 server blades, or by adding additional memory, disks, chassis, with switches and power, to support additional HPE m750 server blades.

The solution is configurable in terms of the number of desired displays for each user, the memory allocated, and the size of the M.2 SSD (up to 4x 3.84 TB) on each server blade.

Tables 8 and 9 contain the server compute that comprises this solution, deployed in either the HPE Moonshot 1500 chassis or the HPE Edgeline EL4000 chassis, respectively. The HPE m750 server blades in Tables 8 and 9 only contain 32 GB RAM and a single 256 GB NVMe drive, but as discussed previously it can be configured with much more memory or storage, as necessary.

Table 10 contains the end-user client hardware that has been tested and validated with this solution, though of course other end-user client hardware options are available and should be chosen based on user needs. Table 10 does not list quantities or part numbers, as these depend on the number of users, their desired display configurations, and all components not sold by HPE.

Table 11 contains the top-of-rack (ToR) switching and cabling, respectively, both of which are optional. ToR switching and cabling are only necessary if it is not already present in the environment.

The solution assumes existing VMware vSphere clustered infrastructure exists for hosting the Horizon and Workspace ONE management components in the customer data center or branch office. If this is not available, an HPE representative can discuss available options for hosting these components either within or outside the HPE Moonshot 1500 chassis.

Depending on the level of high availability and redundancy required, consider increasing the infrastructure and compute components as necessary. HPE recommends keeping available spare systems for blades, endpoints, monitors, and others to address any hardware components that may fail once deployed in a production environment.

The following BOMs contain electronic license to use (E-LTU) parts. Electronic software license delivery is now available in most countries. HPE recommends purchasing electronic products over physical products (when available) for faster delivery and for the convenience of not tracking and managing confidential paper licenses. For more information, contact your reseller or an HPE representative.

### NOTE

Part numbers used are based on the part numbers that were used for testing and subject to change. The bill of materials does not include complete support options or other rack and power requirements and should be used as a starting or reference point only. If you have questions regarding ordering, consult your HPE reseller or HPE sales representative for more details.

**TABLE 8.** Bill of materials (for fully populated HPE Moonshot 1500 chassis with 45 HPE ProLiant m750 blades)

Quantity	Part number	Description
1	P18680-B21	HPE Moonshot 1500 Configure-to-order 2.0 Chassis
1	P18680-B21 ABA	HPE Moonshot 1500 2.0 Chassis US-English Localization Management Module
2	704654-B21	HPE Moonshot-45XGc Switch Module Kit
2	704654-B21 OD1	Factory Integrated
2	783263-B21	HPE Moonshot-16SFP+ Uplink Module Kit
2	783263-B21 OD1	Factory Integrated
45	P17342-B21	HPE ProLiant m750 E-2286M 5.0GHz 8-core 45W Configure-to-order Blade Server
45	P17342-B21 OD1	Factory Integrated
45	P22156-B21	HPE 32GB 2Rx8 DDR4-2933Y-T Kit
45	P22156-B21 OD1	Factory Integrated
45	880262-B21	HPE 256GB NVMe x4 Lanes Read Intensive M.2 2280 1yr Wty Extended Temperature SSD
45	880262-B21 OD1	Factory Integrated





**TABLE 8.** Bill of materials (for fully populated HPE Moonshot 1500 chassis with 45 HPE ProLiant m750 blades) (continued)

Quantity	Part number	Description
45	BD505A	HPE iLO Advanced 1-server License with 3yr Support on iLO Licensed Features
45	BD505A OD1	Factory Integrated
4	684532-B21	HPE 1500W Common Slot Platinum Plus Power Supply Kit
4	684532-B21 OD1	Factory Integrated
1	681254-B21	HPE 4.3U Server Rail Kit
1	681254-B21 OD1	Factory Integrated
1	681260-B21	HPE 0.66U Spacer Blank Kit
1	681260-B21 OD1	Factory Integrated
4	A0K02A	HPE C13 - C14 WW 250V 10Amp 2.0m Jumper Cord
45	E6U64ABE	HPE iLO Advanced Electronic License with 3yr Support on iLO Licensed Features
1	H7J34A3	HPE 3Y Foundation Care 24x7 SVC
1	H7J34A3 Z36	HPE Moonshot Chassis v2 Support
1	HA114A1	HPE Installation and Startup Service
1	HA114A1 56S	HPE Moonshot Install and Startup SVC

**TABLE 9.** Bill of materials (for fully populated HPE Edgeline EL4000 chassis with four HPE ProLiant m750 blades)

Quantity	Part number	Description
1	879808-B21	HPE Edgeline EL4000 10GbE 2xSFP+ v2 Switch System
1	879808-B21 ABA	HPE EL4000 10G 2xSFP+ v2 Switch Sys
2	455883-B21	HPE BladeSystem c-Class 10Gb SFP+ SR Transceiver
2	455883-B21 OD1	Factory Integrated
2	720479-B21	HPE 800W Flex Slot Platinum Hot Plug Power Supply Kit
2	720479-B21 OD1	Factory Integrated
1	868577-B21	HPE Edgeline EL4000 Full Rack Rail Kit
1	814659-B21	HPE Moonshot Server Multipack
4	P17342-B21	HPE ProLiant m750 E-2286M 5.0GHz 8-core 45W Configure-to-order Blade Server
4	P17342-B21 OD1	Factory Integrated
4	P22156-B21	HPE 32GB 2Rx8 DDR4-2933Y-T Kit
4	P22156-B21 OD1	Factory Integrated
4	880262-B21	HPE 256GB NVMe x4 Lanes Read Intensive M.2 2280 1yr Wty Extended Temperature SSD
4	880262-B21 OD1	Factory Integrated
4	E6U64ABE	HPE iLO Advanced Electronic License with 3yr Support on iLO Licensed Features
4	R3K70C	NVIDIA Quadro P1000 Graphics Accelerator for HPE

**TABLE 10.** Suggested thin clients and displays

Description	Product name
<b>Thin Client</b>	HP Inc. t640 Thin Client (Win 10 IoT Enterprise or ThinPro) for three screens or less HP Inc. t740 Thin Client (Win 10 IoT Enterprise or ThinPro) for up to four screens HP Inc. t740 Thin Client (Win 10 IoT Enterprise or ThinPro) with AMD Radeon E9173 PCI Express graphics for up to six screens
<b>Displays</b>	HP Inc. Z27n G2 27-inch QHD Display HP Inc. Z43 42.5-inch 4K UHD Display HP Inc. DreamColor Z32x 31.5-inch 4K UHD Display
<b>Monitor mounts</b>	Ergotron DS100 Quad Monitor Mount Ergotron DS100 Dual Monitor Mount



## Reference guide

**TABLE 11.** Bill of materials (optional top-of-rack switching and cabling)

Quantity	Part number	Description
1	JG896A	HPE FlexFabric 5700 40XG 2QSFP+ Switch
1	JG900A	HPE A58x0AF Back (Power Side) to Front (Port Side) Airflow 300W AC Power Supply
2	JG900A AC3	HPE A58x0AF 300W AC Power Supply Cord
2	JC682A	HPE 58x0AF Back (Power Side) to Front (Port Side) Airflow Fan Tray
2	JD097C	HPE FlexNetwork X240 10G SFP+ SFP+ 3m DAC Cable

## APPENDIX C: RESOURCES

[HPE ProLiant m750 Server Blade QuickSpecs](#)

[HPE Moonshot 1500 Chassis QuickSpecs](#)

[HPE Moonshot Networking Cookbook](#)

[HPE Moonshot Chassis Manager 2.0 User Guide](#)

[HPE Moonshot Chassis Manager 2.0 CLI User Guide](#)

[HPE Moonshot Family Guide](#)

[HPE Edgeline EL4000 System QuickSpecs](#)

[HPE Edgeline EL4000 System User Guide](#)

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